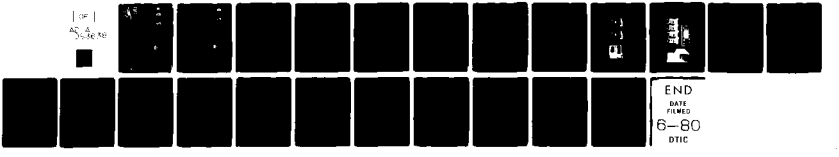
AD-A083 638 ROCKWELL INTERNATIONAL EL SEGUNDO CA NORTH AMERICAN --ETC F/G 1/3
UNIVERSAL ALIGNMENT EQUIPMENT STUDY RESULTS.(U)
APR 80 F33657-79-C-0783
UNCLASSIFIED NA-80-90 NL



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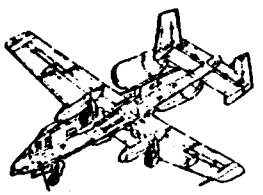
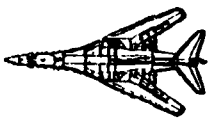




LEVEL II

UNIVERSAL ALIGNMENT EQUIPMENT

STUDY RESULTS

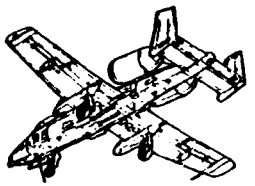
Rockwell International

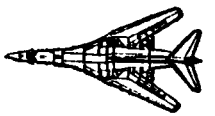
North American Aircraft Division

CONTRACT NO F33657-79-C-0783

02 April 1980

NA-80-90





(11) 02 Apr 80

(6) UNIVERSAL ALIGNMENT EQUIPMENT

STUDY RESULTS

Rockwell International
North American Aircraft Division

CONTRACT NO F33657-79-C-0783
(15)

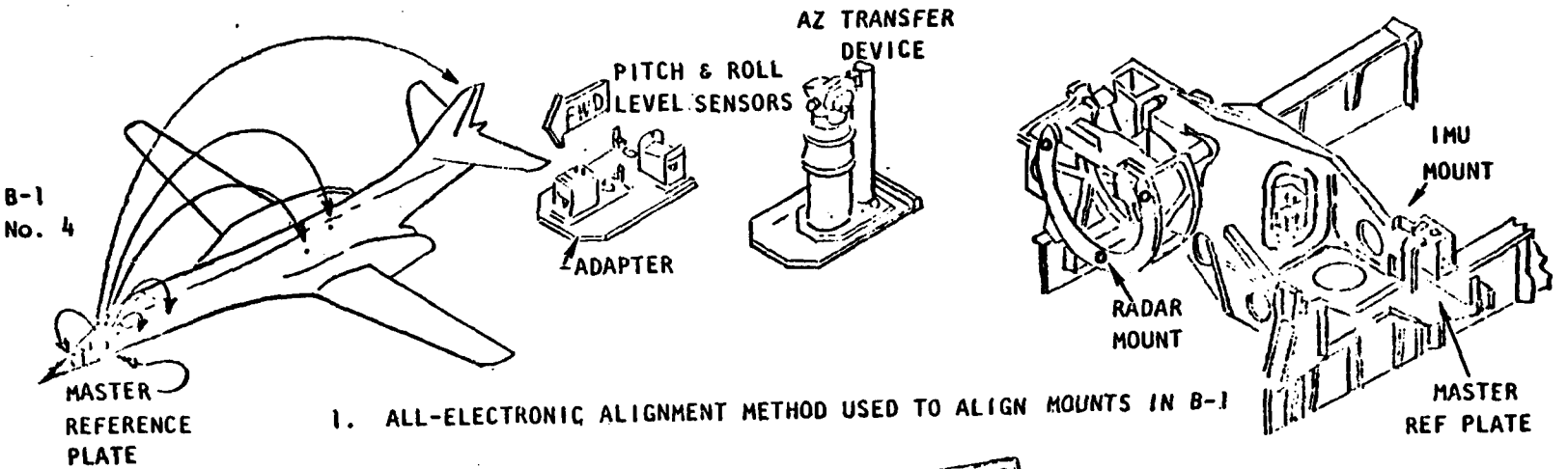
(12) 23

(14) NA-80-90

OUTLINE:

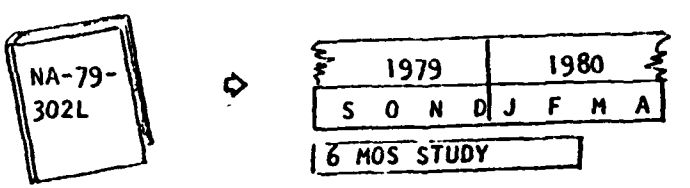
- BACKGROUND;
- UNIVERSAL INSTRUMENTS;
- ELIMINATION OF ADAPTERS;
- INSTRUMENT TECHNOLOGY SURVEY;
- APPLICATIONS TO PRESENT, NEW AIRCRAFT;
- COST EFFECTIVENESS;
- CONCLUSIONS & RECOMMENDATIONS.

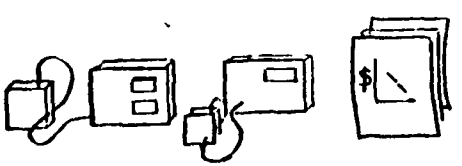
BACKGROUND



1. ALL-ELECTRONIC ALIGNMENT METHOD USED TO ALIGN MOUNTS IN B-1

2. PROPOSAL TO STUDY IMPROVED, UNIVERSAL ALIGNMENT METHOD





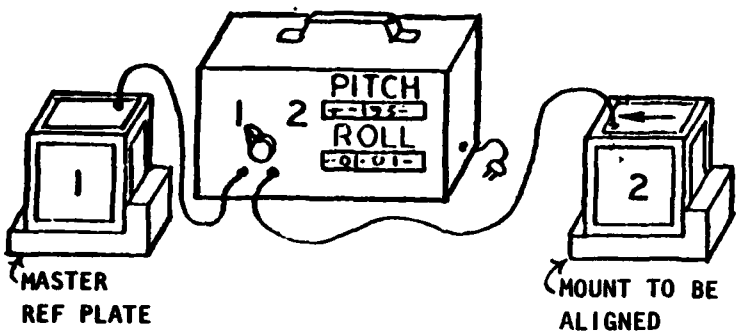
3. OBJECTIVES:
DEFINE AND JUSTIFY
UNIVERSAL INSTRUMENTS &
COMPATIBLE MOUNTS,

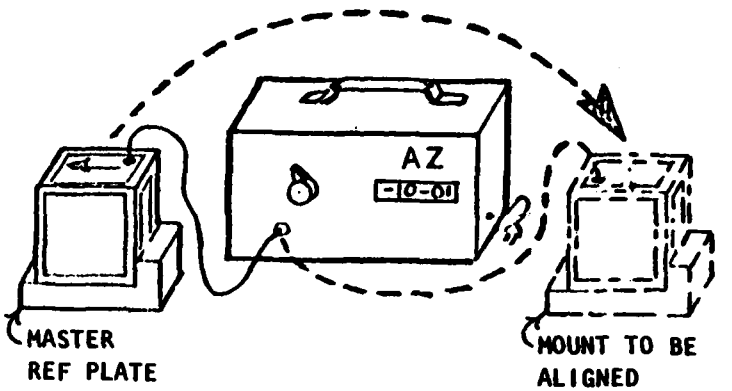
4. STUDY APPROACH:
- DEFINE REQUIREMENTS
- CONDUCT INSTRUMENT SURVEY
- ANALYZE OPTICAL VS ELECTRONIC ALIGNMENT ON NEW AIRCRAFT, ON F-15, A-10, B-52 OAS
- CONDUCT COST EFFECTIVENESS EVALUATION
- PREPARE SPEC FOR NEW MOUNTS

DESIRED IMPROVEMENTS

- ELIMINATE ALIGNMENT ADAPTERS AND FIXTURES
- SIMPLIFY ALIGNMENT OPERATIONS
  - PROVIDE DIRECT, INSTANT READOUTS OF ALIGNMENT
  - AVOID NEED TO MOVE OR STABILIZE AIRCRAFT

RECOMMENDED REQUIREMENTS FOR UNIVERSAL ALIGNMENT INSTRUMENTS





2 - AXIS DIFFERENTIAL LEVEL SENSOR SYSTEM

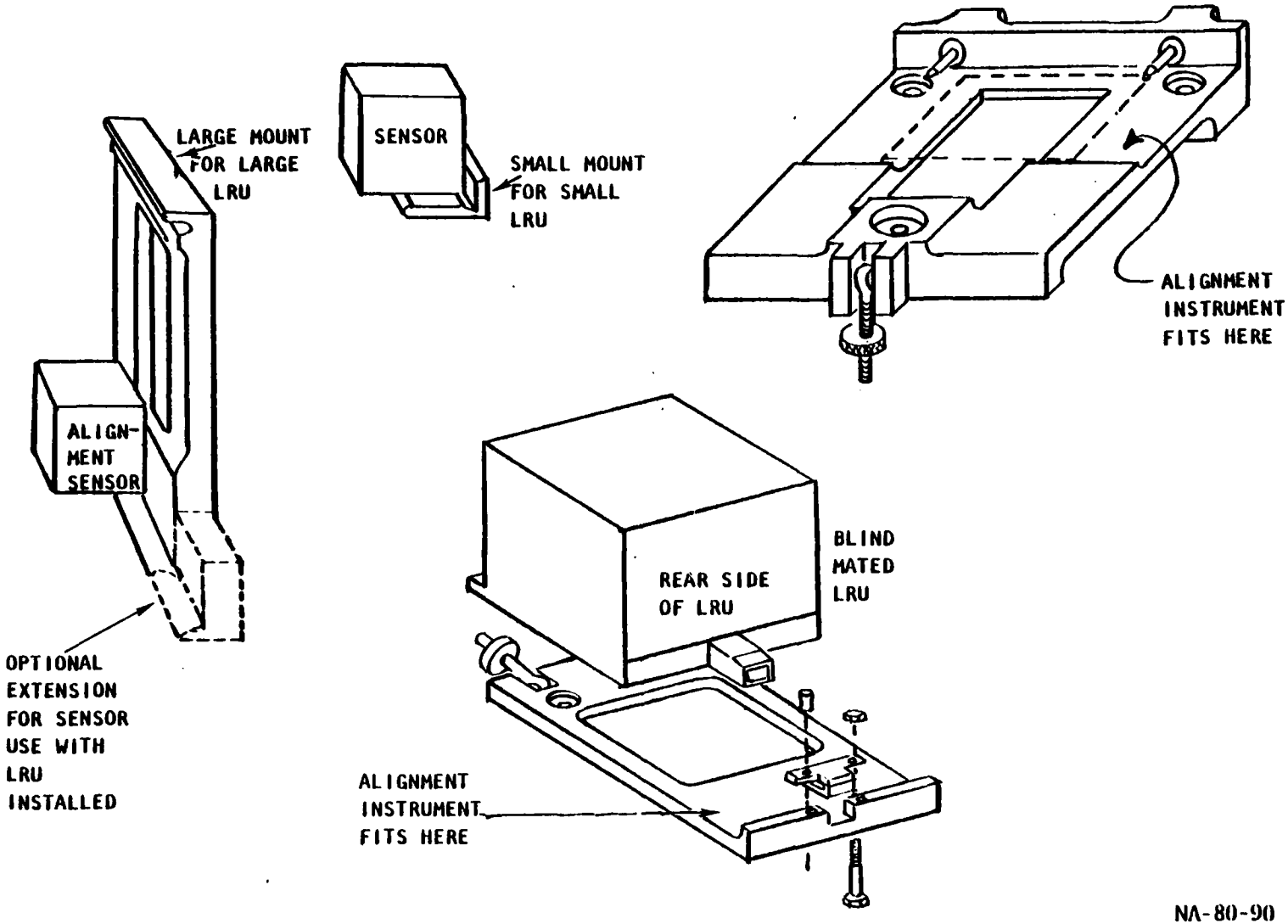
±0.10 MRAD PITCH & ROLL TRANSFER ACCY
CONTINUOUS READOUTS: 1 SEC SETTLING TIME
SAME SIZE SENSOR MODULE AS AZ XFR DEVICE
OPERABLE BY UNTRAINED PERSONNEL
WEIGHT GOAL: UNDER 10 LB TOTAL
RDT&E LIMIT: $100K
COST GOAL: UNDER $15K

AZ DIRECTIONAL GYRO TRANSFER DEVICE

±0.10 MRAD TRANSFER ACCY FOR 0.1 HR
±0.50 ACCY FOR 0.5 HR DRIFT TIME
5 INCH CUBICAL SENSOR MODULE
OPERABLE BY UNTRAINED PERSONNEL
WEIGHT GOAL: UNDER 20 LB TOTAL
RDT&E LIMIT: $500K
COST GOAL: UNDER $50K

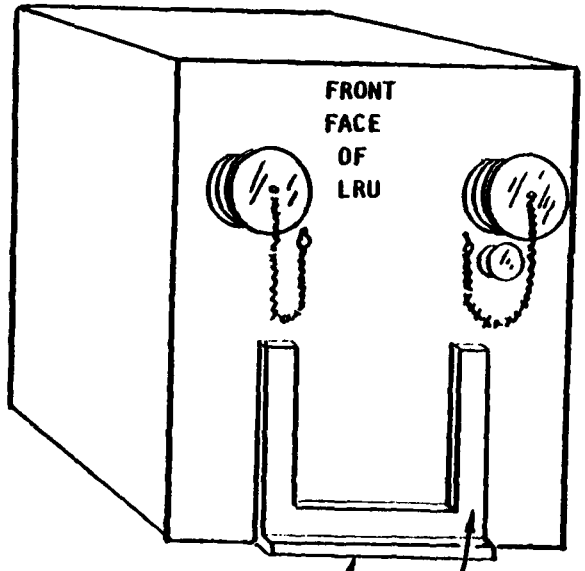
NA-80-90

EXAMPLES OF MOUNTS WHICH REQUIRE NO ALIGNMENT ADAPTERS FOR UNIVERSAL ALIGNMENT INSTRUMENTS

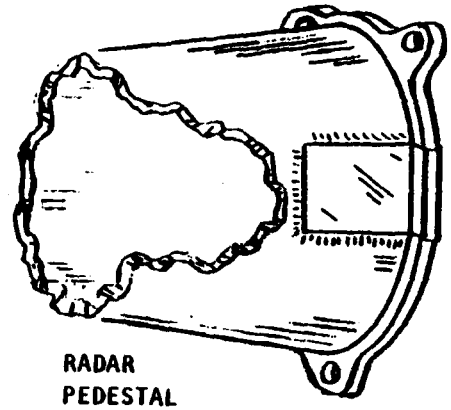


NA-80-90

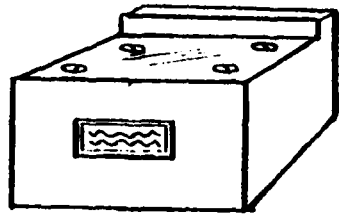
EXAMPLES OF LRU'S WHICH ARE DIRECTLY COMPATIBLE WITH ALIGNMENT INSTRUMENTS



INERTIAL
MEASUREMENT
UNIT



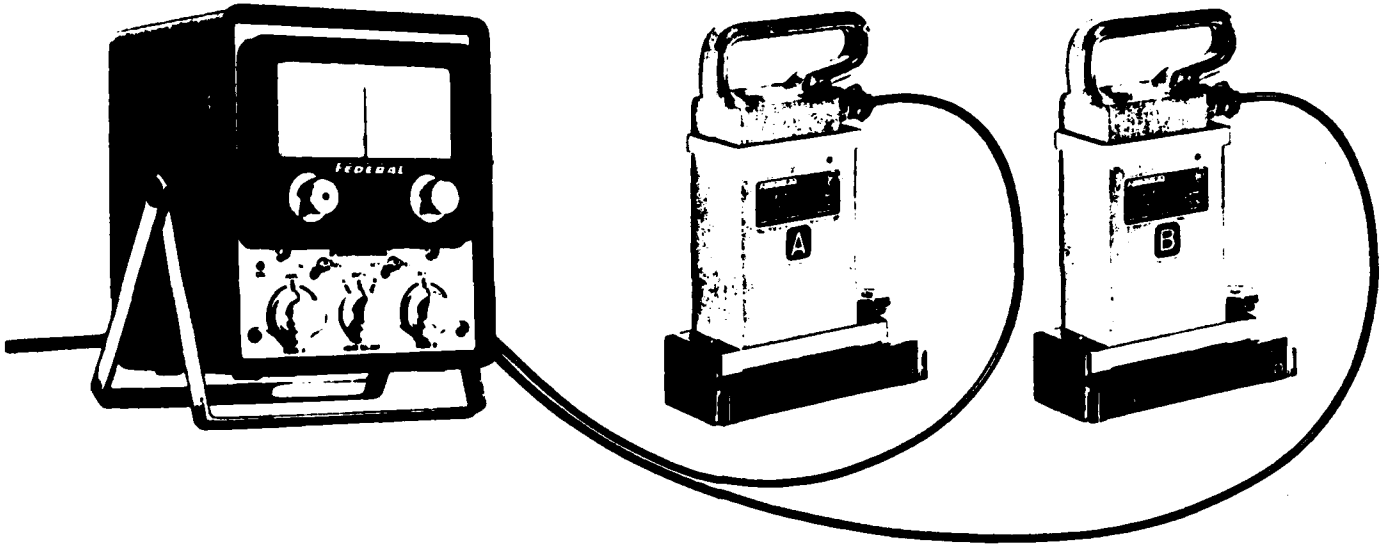
RADAR
PEDESTAL



STRAPDOWN
GYRO OR
ACCELEROMETER
PACKAGE

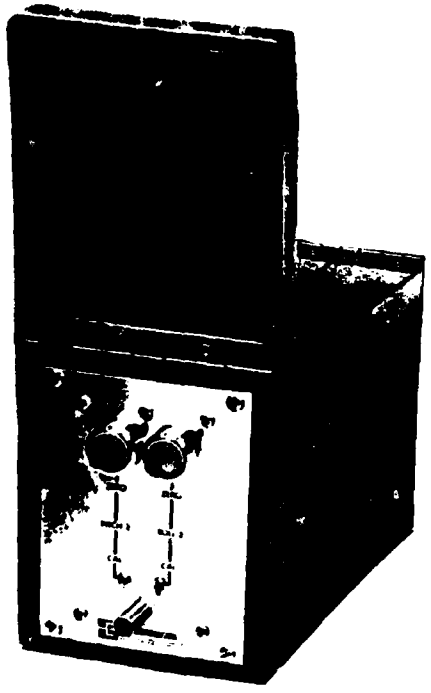
NA-80-90

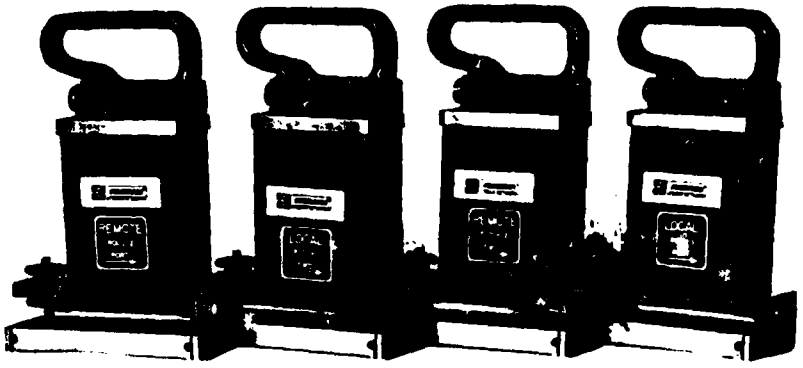
EXAMPLE OF OFF-SHELF LEVEL SENSORS

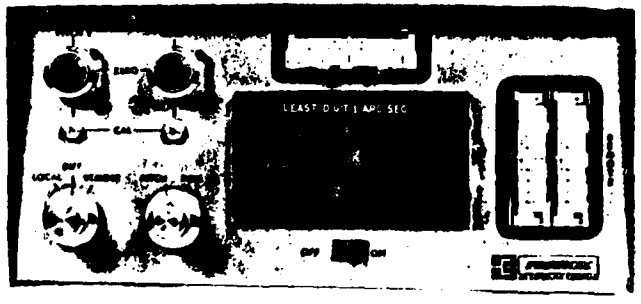


- 5 SCALES
- ADJUSTABLE BASES
- 1 ARC SEC ACCY
- ABSOLUTE OR DIFFERENTIAL READINGS
- $4 K
- FEDERAL PRODUCTS CORP

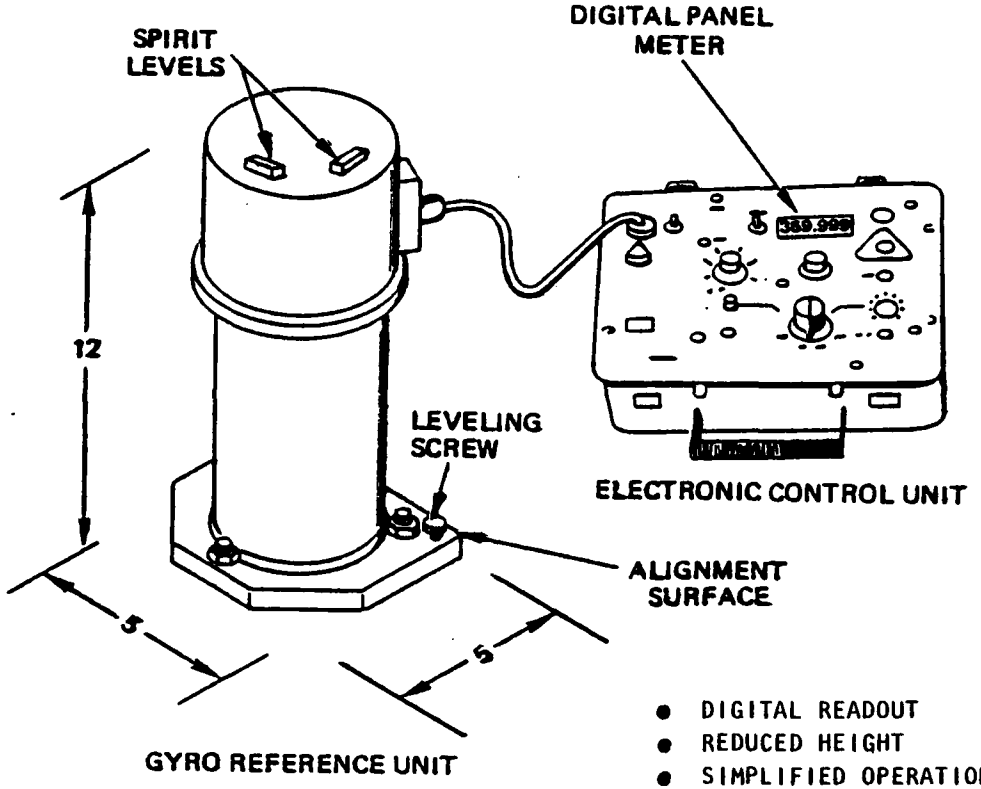
OFF-SHELF DIGITAL DIFFERENTIAL LEVEL SENSOR SYSTEM







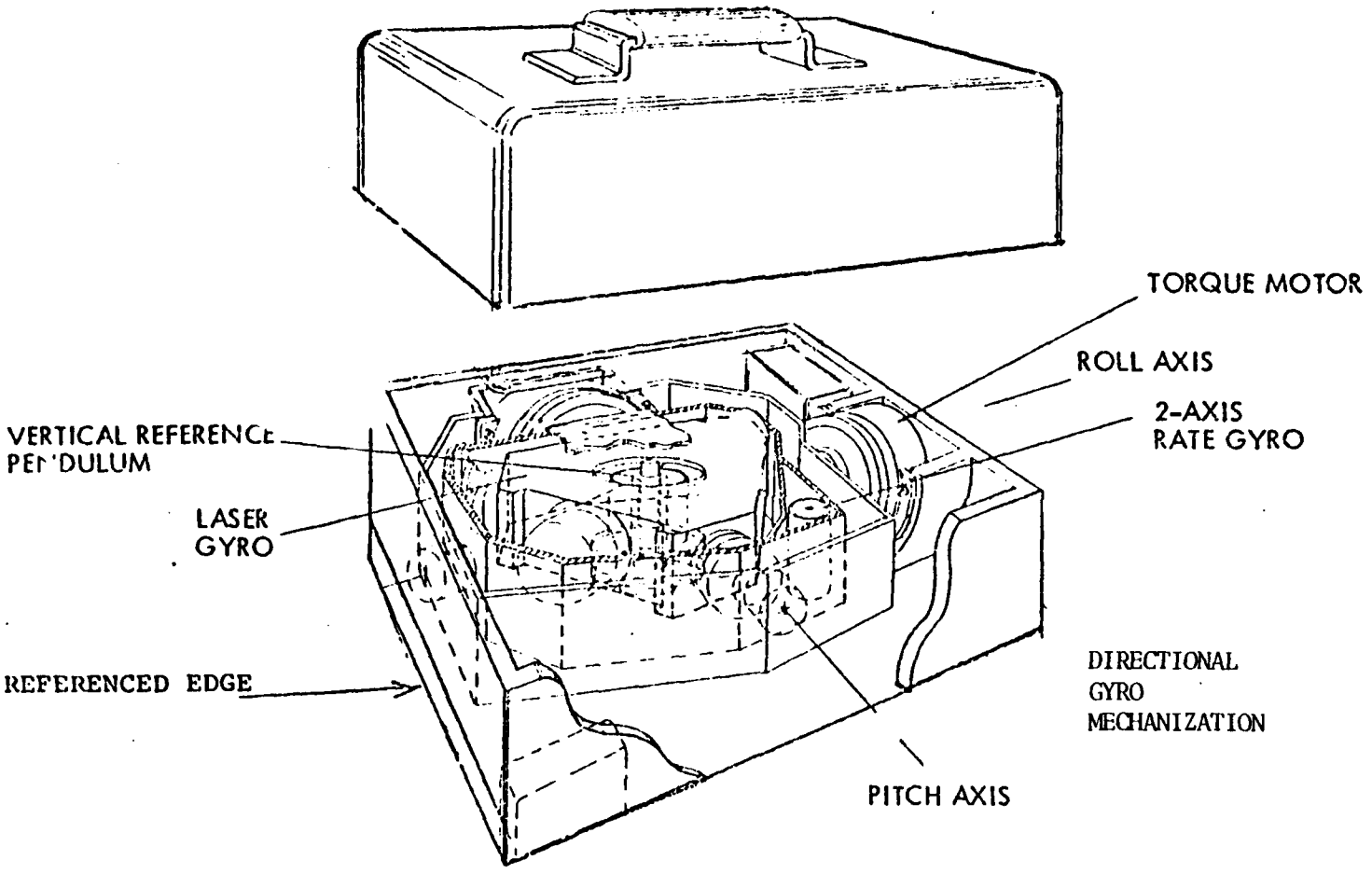
IMPROVED VERSION OF AZ TRANSFER DEVICE USED ON B-1



- DIGITAL READOUT
- REDUCED HEIGHT
- SIMPLIFIED OPERATION
- FASTER SETTLING
- LESS VIBRATION SENSITIVITY
- $250 K - 350 K RDT&E
- $150 K TOOLING
- $32 - 33 K EACH

NA-80-90

AZ GYRO TRANSFER DEVICE PROPOSED BY RAYTHEON



REMOTE ELECTRONICS
UNIT NOT SHOWN

NA-80-90

INSTRUMENT SURVEY RESULTS

- DIGITAL DIFFERENTIAL LEVEL SENSOR SYSTEM CAN BE DEVELOPED TO REQUIREMENTS IN 10-12 MONTHS WITH LOW RISK

	RDT&E*	PRODUCTION
AUTONETICS REPACKAGED TILTMETER	$ 95 K	$15 K
REPACKAGED FED PROD CORP QUAD SENSOR	UNK	$17 K NOW
GOALS:	$100 K MAX	$15 K MAX

- AZ GYRO TRANSFER DEVICE TECHNICALLY FEASIBLE: SOME COST RISK

  - 12-15 MONTHS DEVELOPMENT TIME
  - DIRECTIONAL GYRO MECHANICATION PREFERRED, OBTAINABLE
  - 5 INCH SENSOR CUBE (APPROX) OBTAINABLE
  - 0.1 MRAD/0.1 HR & 0.5 MRAD/0.5 HR ACCY OK

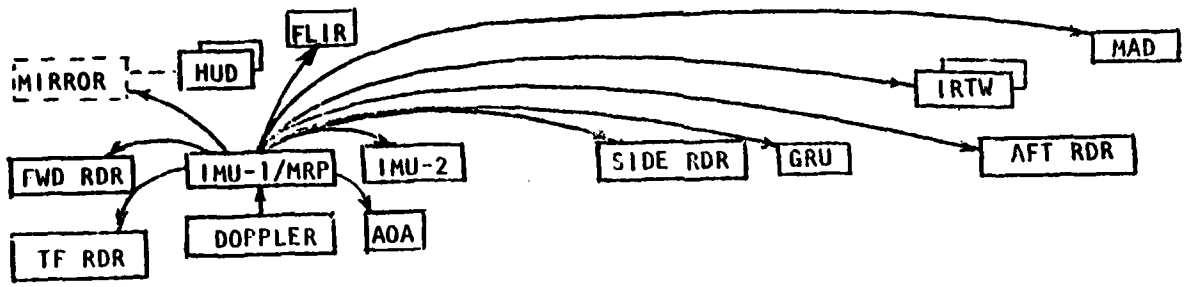
	RDT&E*	PRODUCTION
RAYTHEON RING LASER GYRO DG MECH	$500 K	$ 45 K
LEAR SIEGLER STRAPDOWN DG MECH	$440 K	$ 45 K
LITTON LR-80 STRAPDOWN GYRO MOD	$540 K	$190
GOALS:	$500 K MAX	$ 50 K MAX

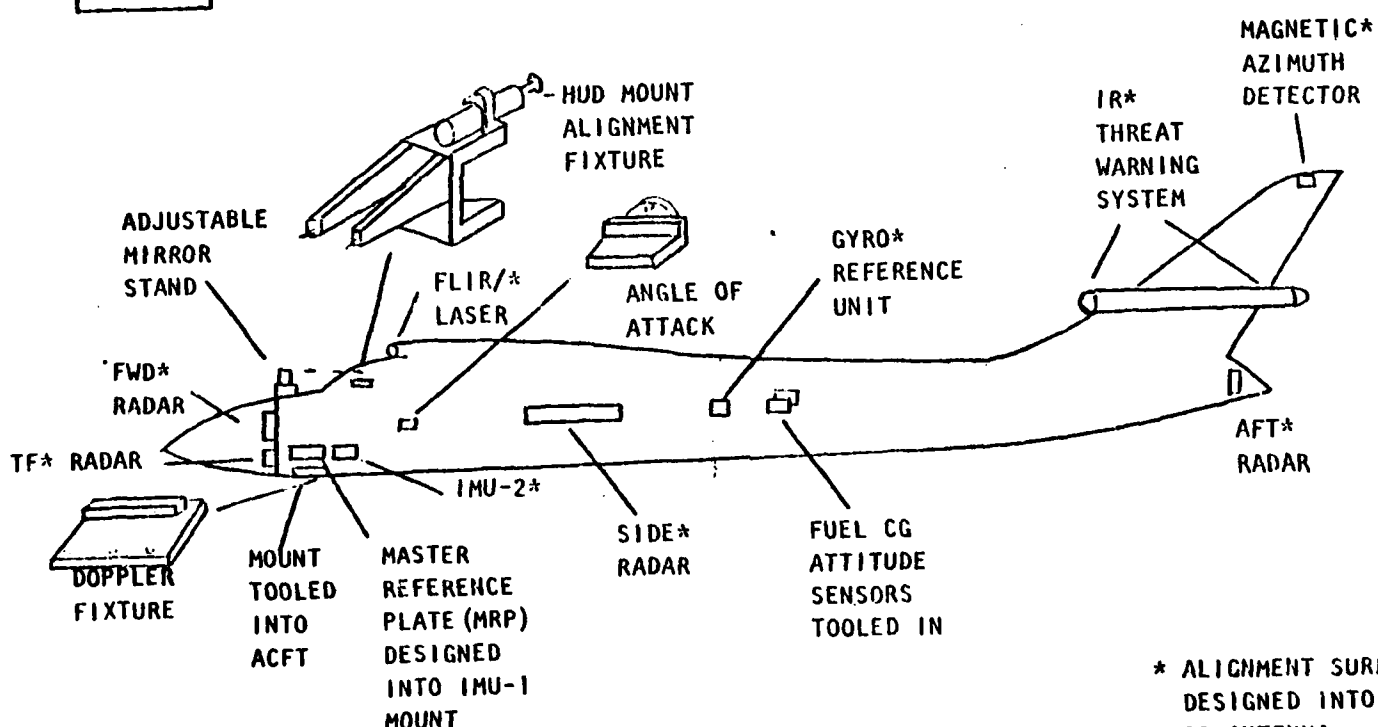
- MONITOR NAVY EFFORT TO AVOID DUPLICATION

*WITH FIRST UNIT

NA-80-90

ELECTRONIC ALIGNMENT CONCEPT
FOR HYPOTHETICAL NEW AIRCRAFT

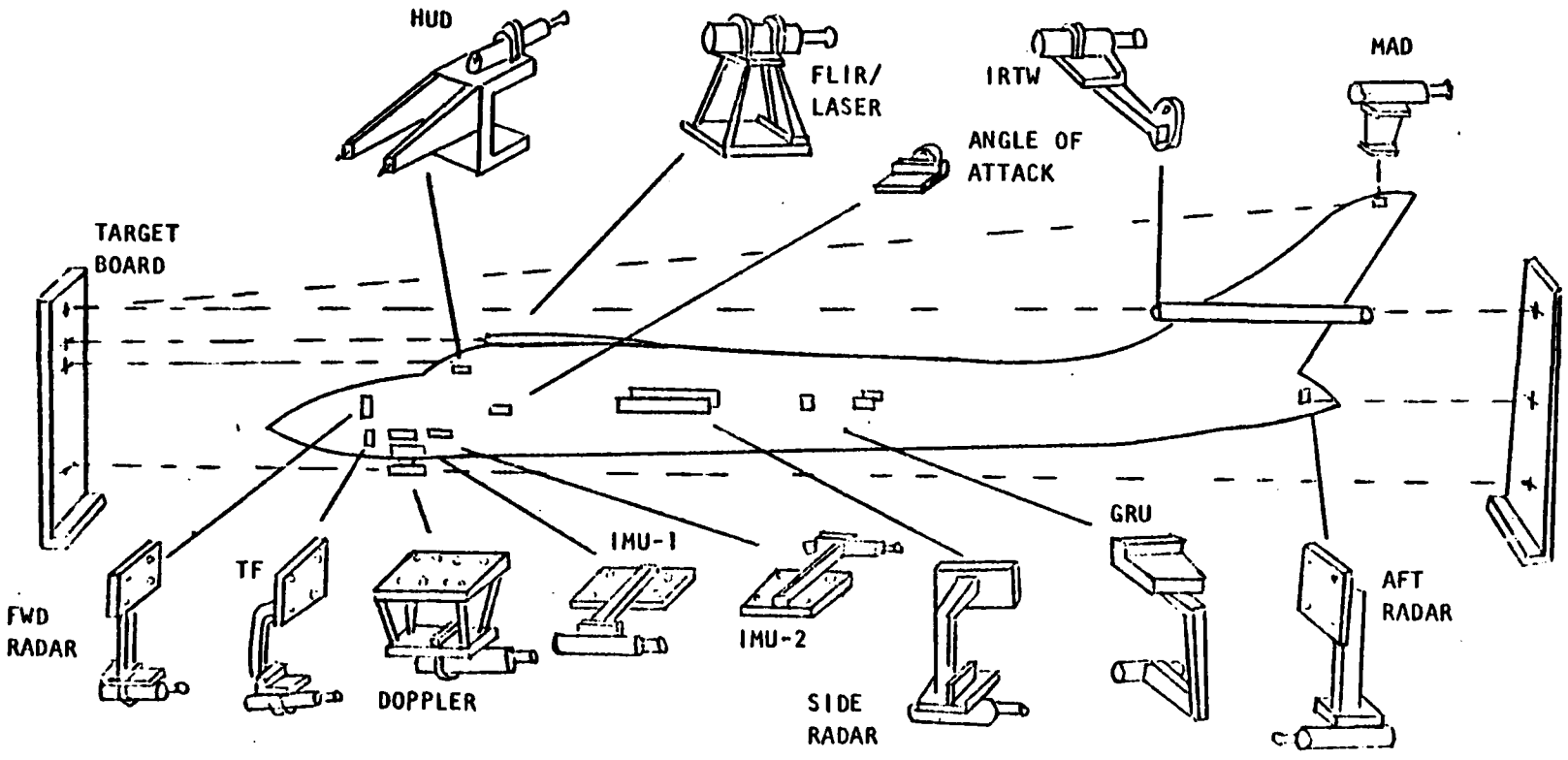




* ALIGNMENT SURFACES
DESIGNED INTO MOUNT
OR ANTENNA

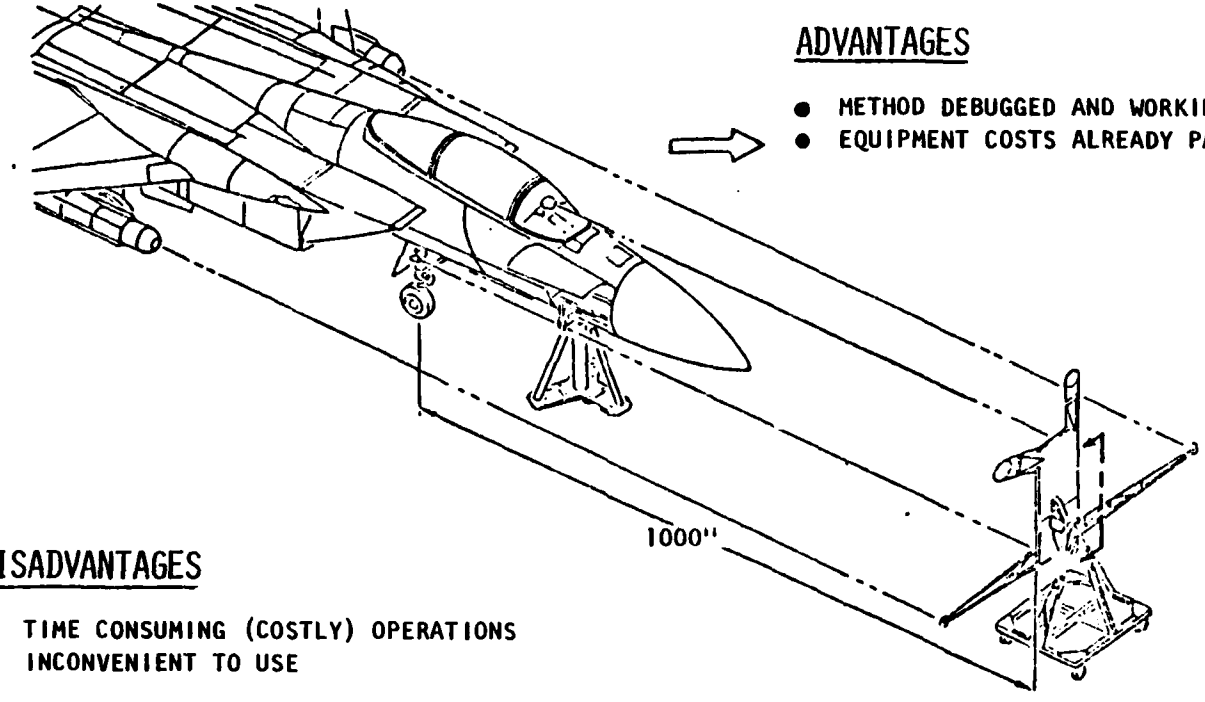
NA-80-90

OPTICAL ALIGNMENT METHOD
FOR HYPOTHETICAL NEW AIRCRAFT



NA-80-90

OPTICAL ALIGNMENT METHOD IN USE ON F-15



ADVANTAGES

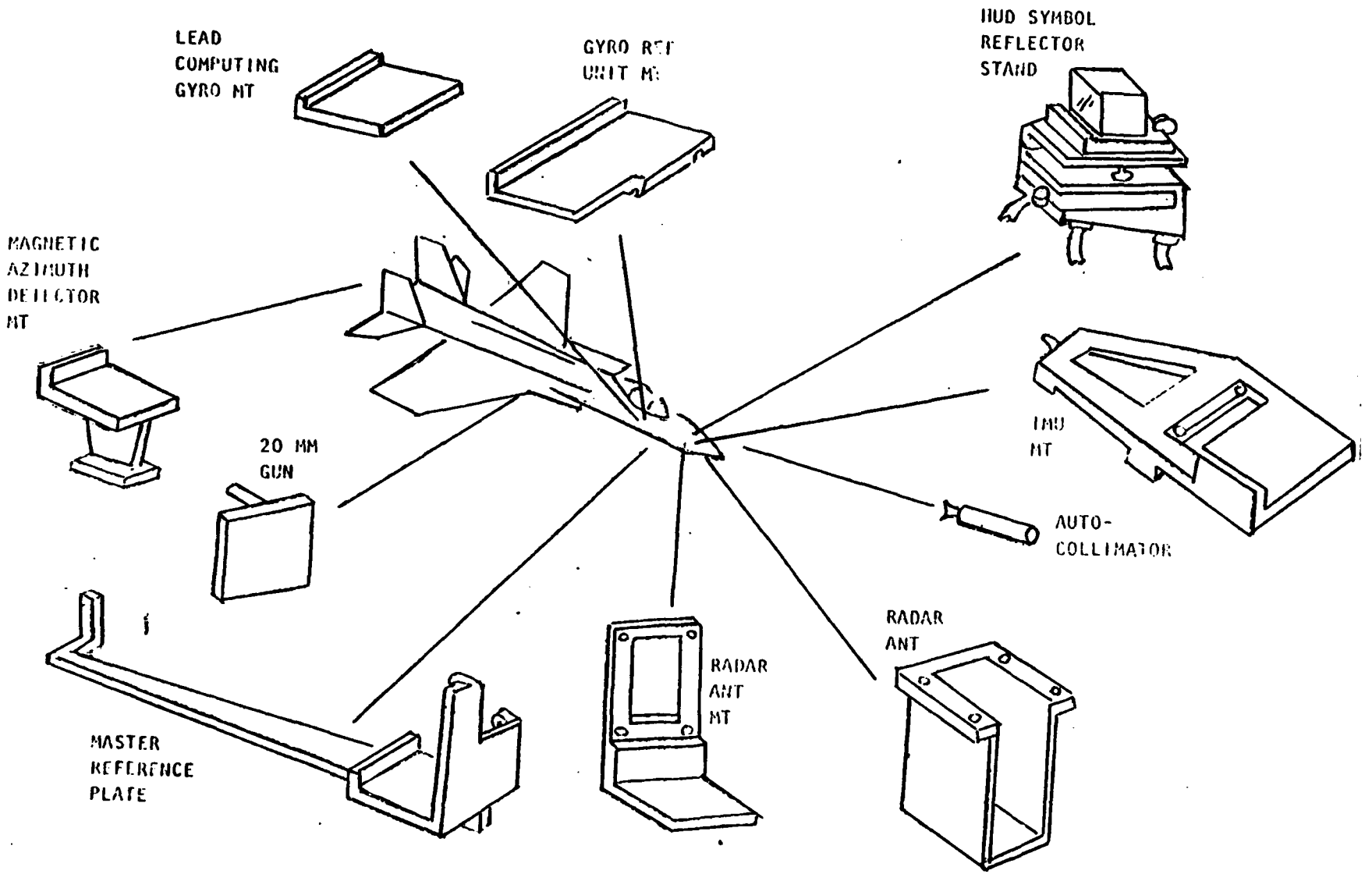
- METHOD DEBUGGED AND WORKING WELL
- EQUIPMENT COSTS ALREADY PAID

DISADVANTAGES

- TIME CONSUMING (COSTLY) OPERATIONS
- INCONVENIENT TO USE

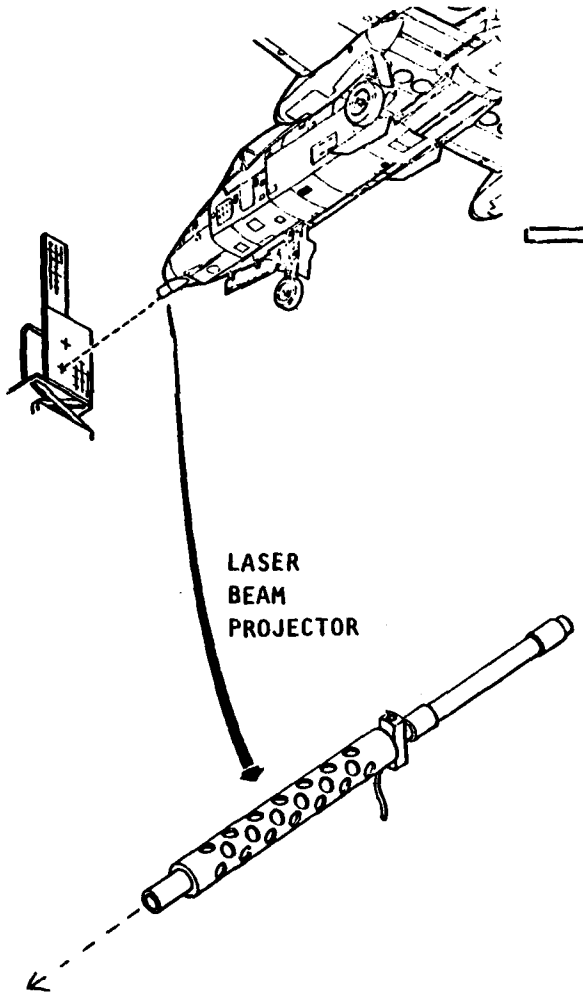
NA-80-90

ADAPTERS NEEDED FOR ELECTRONIC ALIGNMENT ON F-15



NA-80-90

LASER ALIGNMENT METHOD PRESENTLY USED ON A-10



ADVANTAGES

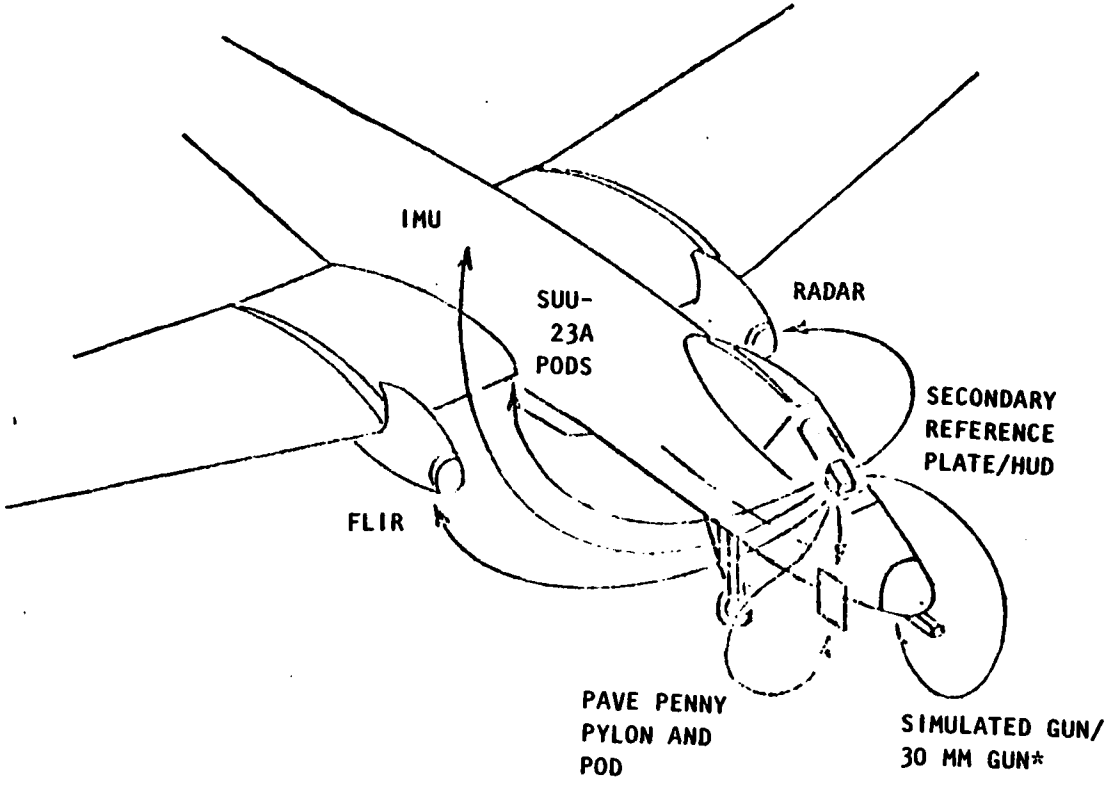
- METHOD DEBUGGED AND WORKING WELL
- EQUIPMENT COSTS ALREADY PAID

DISADVANTAGES

- LESS CONVENIENT THAN ELECTRONIC ALIGNMENT

NA-80-90

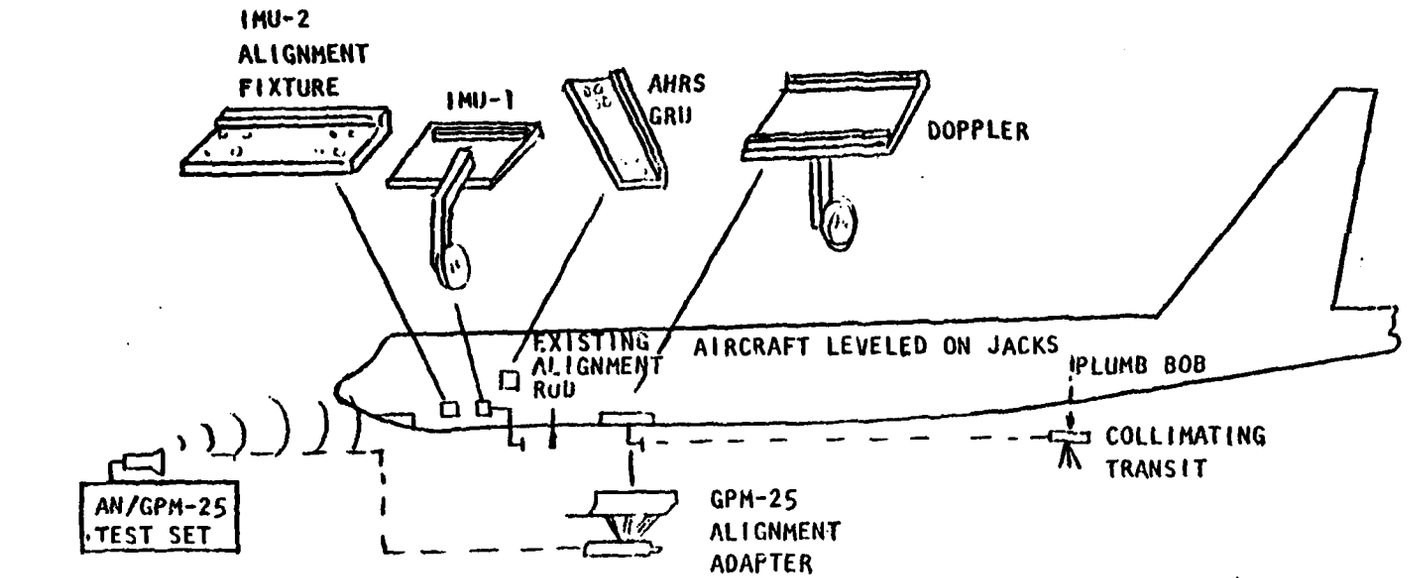
ELECTRONIC ALIGNMENT CONCEPT FOR A-10
NIGHT/ADVERSE WEATHER VERSION

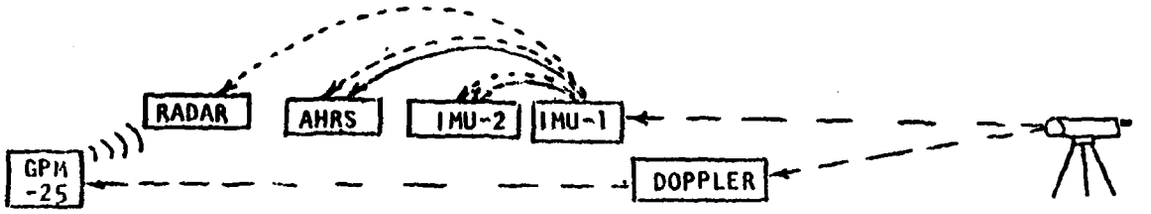


*ADAPTERS
REQUIRED,
BUT NOT
SHOWN HERE

NA-80-90

BOEING B-52 OAS ALIGNMENT METHOD





— — — OPTICAL ALIGNMENT, AZ
——— MECHANICAL ALIGNMENT, AZ
- - - - - - TRANSFER ALIGNMENT, PITCH AND ROLL

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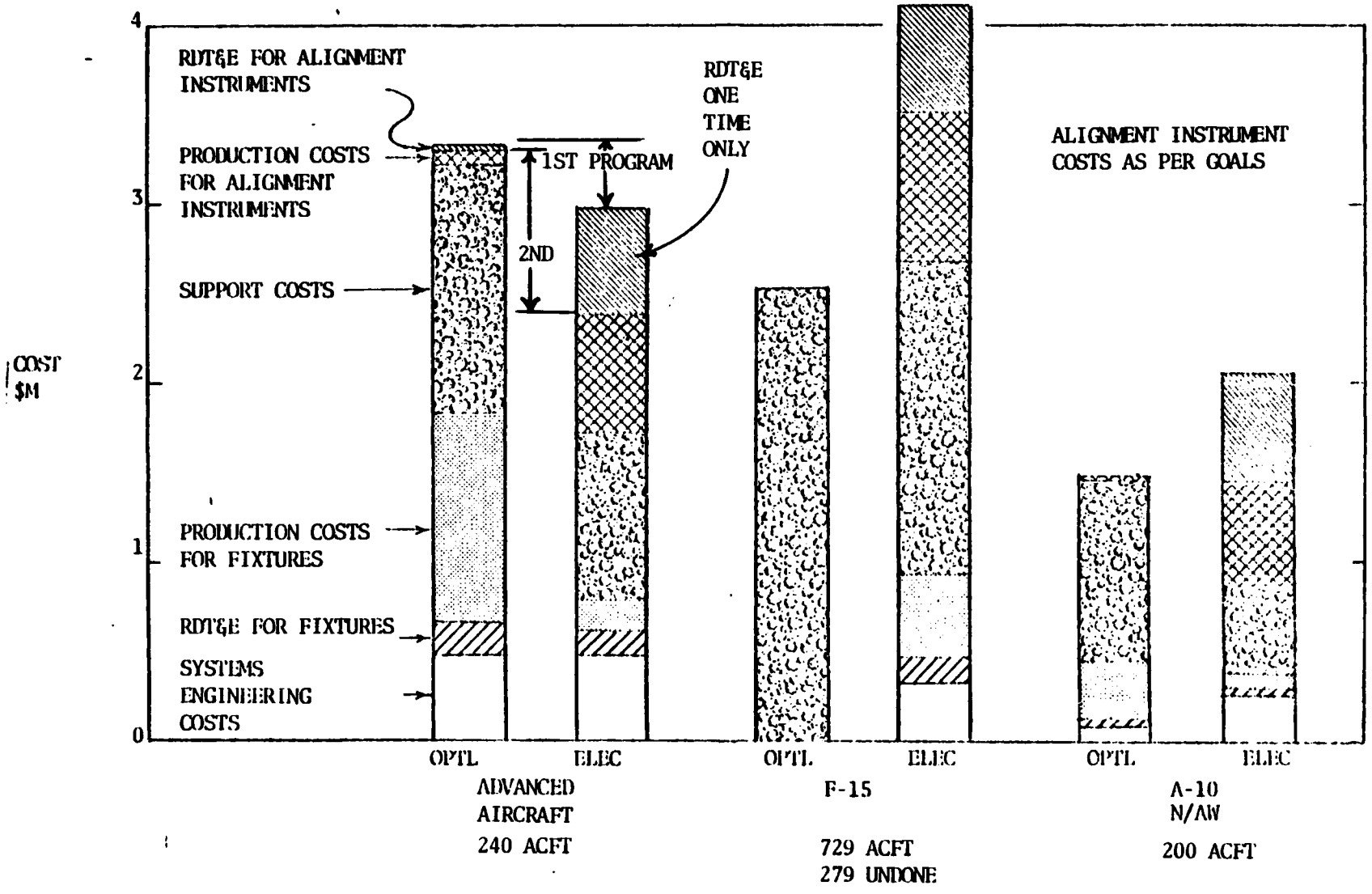
MOUNT ALIGNMENT LIFE CYCLE COSTS



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ADVANTAGES OF UNIVERSAL ALIGNMENT INSTRUMENTS

- NO/FEW ADAPTERS TO DESIGN AND PRODUCE FOR NEW AIRCRAFT
- NO DEDICATED WORK SPACE OR SCHEDULE TIME NEEDED
- NO AIRCRAFT STABILIZATION REQUIRED
- NO SPECIAL TRAINING
- INSTANT READOUT OF ALIGNMENT
- EASY ACCESS TO MOUNT ADJUSTMENTS
- HIGHLY ACCURATE
- ADAPTABLE TO ALIGNMENT CHECKS WITH LRU'S INSTALLED
- RE-USE OF INSTRUMENTS ON OTHER PROGRAMS

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

- WITHIN PRESCRIBED LIMITS, UNIVERSAL ALIGNMENT INSTRUMENTS ARE COST-EFFECTIVE (BREAK-EVEN ON 1ST PROGRAM, SAVE ON 2ND)
- INSTRUMENT PERFORMANCE REQUIREMENTS ARE PRACTICAL AND OBTAINABLE
- PRESCRIBED INSTRUMENT COST LIMITS APPEAR OBTAINABLE
- PRESENT AIRCRAFT SHOULD BE LEFT UNCHANGED

RECOMMENDATIONS

- PREPARE INSTRUMENT RFP'S
- PROCEED WITH DEVELOPMENT IF PROPOSALS SATISFY COST GOALS
- CONVERT MOUNT CRITICAL ITEM SPEC TO MIL-STD SPEC
- EMPLOY UNIVERSAL INSTRUMENTS ON NEXT AIRCRAFT PROGRAM